Optimised Visual Outcome After Asymmetrical Multifocal IOL Rotation

CASE REPORT

Title: Optimised visual outcome after asymmetrical multifocal IOL rotation

Authors: Eric E Pazo MD[1, 2], Olivier Richoz MD PhD[3], Richard McNeely BSc[1, 2], Zachary A Millar [4,] Tara CB Moore PhD[2], Jonathan E Moore PhD FRCOphth[1, 2].

1 Cathedral Eye Clinic, University of Ulster, 89-91 Academy Street, Belfast, UK.

2 Biomedical Sciences Research Institute, University of Ulster, Coleraine, UK.

3 Department of Ophthalmology, Royal Victoria Hospital, Belfast, UK.

4 Faculty of Biology, University of Cambridge, Cambridgeshire, UK.

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Name and address of author to receive reprint requests:

Professor Jonathan E Moore, 89-91 Academy Street, Belfast, Co Antrim, BT1 2LS. Tel: +44 28 90322020 Fax: +44 28 90321808 Email:

jmoorecathedral@gmail.com

PRECIS

Asymmetrical IOLs require active management to maximise the surface area of either the distance or near-add, between the dominant and non-dominant eyes, to ensure optimal visual performance.

ABSTRACT

Purpose: To report an improved visual outcome after rotation of an asymmetrical multifocal intraocular lens.

Methods: A 58-year-old patient underwent bilateral phacoemulsification with asymmetrical multifocal intraocular lens (MFIOL) implantation. Subsequently postop the IOL was rotated to improve pupil centration.

Postop UDVA in both eyes was 0.0 logMAR, UNVA in both the eyes was 0.0 logMAR. QOV questionnaire scores for day and night were 5 and 7 respectively. The centre of the MFIOL in the dominant eye was initially found to be 0.2 mm supero-temporally displaced increasing the percentage area of 'near-add' compared to 'distance-add' within the physiological pupil. Rotation of this IOL 120° clockwise greatly improved the IOL centration within the pupil centre and resulted in an immediate improvement in UDVA to -0.1 logMAR and simultaneously QOV to 8 and 9 respectively.

Conclusions: Assessment of the centration of an asymmetrical MFIOL is important particularly if there are dysphotoptic or other visual complaints.

Introduction

The aim of multifocal intraocular lens (MFIOLs) use is to restore distance, intermediate and near visual function post cataract surgery. The new generation of refractive radially asymmetrical MFIOLs' aim to alleviate the occurrence of optical side effects. The SBL-3 (Lenstec, Inc.) is a bi-aspheric asymmetrical refractive MFIOL with a +3.00 D add in the inferior anterior optic (figure 1). A transition zone separates the distance and the near-add sections of the lens and the near segment occupies 42% of the total lens optic.

We report a case in which a patient underwent bilateral implantation of asymmetrical MFIOL; the near-add in both eyes was positioned infero-nasally as per manufacturer recommendation. During the 1-month post-cataract surgery assessment the patient complained of problems driving during the day and problems with vision in supermarket lighting. It was noted that under photopic conditions the exposure of the near-add was maximised in the patient's dominant eye thereby resulting in a myopic state of accommodation. To alleviate the patient's myopic state during photopic conditions the MFIOL in the dominant eye was rotated 120° clock wise to a supero-temporal position. One month after the MFIOL rotation (2-months post cataract extraction) the patient was invited for an assessment and reported vision problems with night-driving and in the supermarket were alleviated and quality of vision was greatly improved. This improvement in the quality of vision was found to be stable during the patient's 4-month post-operative (3 month post rotation) ophthalmic assessment (Table 1). To our knowledge, this is the first report of decentration of a new radially asymmetric MFIOL and alleviation of the decentration by rotation.

CASE REPORT

A 58-year-old man presented at the ophthalmology clinic with gradually decreased visual acuity because of bilateral cataract. On presentation, unaided distance visual acuity (UDVA) in the right and left eye was 0.5 logMAR and 0.6 logMAR. Unaided near visual acuity (UNVA) for the right and left was 0.4 logMAR and 0.2 logMAR. Using a validated questionnaire, the quality of vision (QOV) pre-operatively was recorded to be 4 and 3 (on a scale of 0-10) for day and night respectively. The IOL-Master (Zeiss) device was used to measure corneal curvature, anterior chamber depth, axial length, and subsequent IOL calculation using the Hoffer Q formula.

Cataract extraction with asymmetrical multifocal intraocular lens implantation was performed in both eyes. The near-add was placed infero-nasally in both eyes by an experienced surgeon (JEM). Standard sutureless on-steep axis corneal phacoemulsification (2.8 mm incision) was performed with a uniform capsulorhexis of 5.2 mm.

One month after this uneventful cataract surgery, the patient complained that he was experiencing difficulty with vision while driving during the day and in supermarkets. On assessment, the UDVA in both eyes was 0.0 logMAR. UNVA also improved in both the eyes to 0.0 logMAR. QOV questionnaire scores for day and night were still low at 5 and 7 respectively (pre cataract extraction:- 4 and 3 respectively). Slitlamp anterior segment and fundus examinations were unremarkable and the near-add of the MFIOL was confirmed to be oriented infero-nasally in both eyes.

On assessing the pupil of the dominant eye under photopic conditions using a slitlamp; it was observed that the near-add surface had high exposure in the dominant eye. Digital retro-illumination photographs were taken of dilated and undilated pupil. Adobe PS suite (Adobe Systems Inc, San Jose, California) was used to determine surface area exposure, decentration, capsular dimension changes and pupil shift. After the risk and benefits were explained to the patient, the infero-nasally placed (near-add) asymmetrical MFIOL in the dominant right eye was rotated 120° clockwise to a more supero-temporally positioned near-add (figure 2a) 1-month post cataract operation, ensuring that a more normal degree of distance-add was now present within the physiological pupil.

Three month following IOL rotation surgery the UDVA in both eyes was -0.1 logMAR. UNVA in both the eyes was -0.1 logMAR (Table 1). The patient was happy with driving and seeing in the supermarket during the day. This improvement in satisfaction of visual performance was reflected in the QOV questionnaire scores with day and night scores of 8 and 9 (1-month post rotation) and after 3-months post rotation the QOV vision was 9 for QOV day and 9 for QOV night, which was previously 5 and 7 for day and night respectively (prior to rotation). The final position of the MFIOL near-add in the left eye was infero-nasal and supero-temporal in the right eye (figure 2a and 2b).

DISCUSSION

SBL-3 multifocal IOL is a relatively new lens; the recent case series of bilateral implantation on 53 eyes published by Venter *et al.,* reported a good range of

distance, intermediate and near visual acuity in patients.[1] The rotation of asymmetrical MFIOL on it's axis was compared before by Moore *et al* [2] and found that the placement of the near-add in the superior or inferior position in Mplus (Lentis, Inc.) had no significant overall difference in the mean subjective or objective outcomes [2]

Decentration of any MFIOL can lead to decreased visual acuity and photopic phenomenon, which has an adverse affect upon the quality of vision for the patient. [3] The effect of decentration of a multifocal IOL upon visual quality can be further compounded by a large angle kappa, resulting in central optical rays potentially passing through the periphery of the MFIOL rather than its centre.[4] The centration of any MFIOL with respect to the physiological pupil centre can be difficult principally as this is dictated generally by the position of capsular bag periphery.[5] SBL-3 is radially asymmetric and centration appears to play a crucial role for good quality of vision as documented in this particular case report where the supero-temporal displacement of approximately 0.2 mm in the dominant eye from the centre resulted in poor quality of vision. Possible factors that may have influenced this decentration with respect to the physiological pupil include capsular contraction, haptic movement, IOL rotation or pupil shift. [3,6,7]

Pupil shift refers to a slight change in reference to the pupil's central location between mesopic, photopic, and pharmacologically dilated conditions [8] and this tendency of the pupil to shift makes it all the more difficult for a precise positioning of the asymmetrical MFIOL. Closer examination of the photopic pupil of the patient's dominant eye revealed that a photopic pupil shift occurred towards the infra-nasal

region [9] and thereby maximised the light exposure to the inferiorly placed near-add of the IOL; making distance vision during photopic conditions difficult for the patient.

In summary, postoperative rotation of asymmetrical MFIOL can be beneficial for some patients experiencing dysphotopsia and poor quality of vision (figure 2a). It is key to ensure that that the dominant eye is optimised for distance viewing by maximising the area of distance add within the mesopic and photopic pupil. Determining where the physiological pupil centre lies during surgery in an attempt to centre the IOL within a pharmacologically dilated pupil is difficult. What we can deduce however from this case report is that rotation of the IOL can result in different final positions for the centre of the IOL. This is due to the asymmetric nature of the capsular bag [10] and the differences between the centre of the bag and the centre of the pupil. Asymmetrical MFIOLs are not circular and nor is the capsular bag, therefore one can actively alter the resultant centration of the IOL by rotating it into different positions. Taking these factors into consideration the near-add positioning should be assessed individually for optimal positioning of MFIOL and potentially different positions utilised for the dominant and non-dominant eyes.

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196 **FIGURES LEGENDS**

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198 **Figure 1**. Lenstec SBL-3, asymmetrical multifocal intraocular lens.

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200 **Figure 2a**. Pupil (right eye) under pharmacological dilated conditions, post rotation of
201 MFIOL. Superio-temporal positioned near-add.

202

203 **Figure 2b.** Pupil (left eye) under pharmacological dilated conditions, infero-nasally
204 positioned near-add.

Table 1. Comparative Pre-op and post-operative data.				
Biometry (preoperative)				
	OD		OS	
AL	23.65 mm		23.51 mm	
K1	41.46 D 10°		41.56 D 155°	
K2	41.87 D 100°		41.77 D 65°	
ACD	3.00 mm		3.05 mm	
Angle kappa	4.02°		3.75°	
Photopic pupil	3.2 mm		3.3 mm	
Mesopic pupil	4.1 mm		3.8 mm	
Sphere (D)	1.5		1.4	
Mean corneal astigmatism (D)	0.74		0.6	
	Pre-op	**Post-op 1 month**	**Post rotation 1-month**	**Post rotation 3-months**
Visual Acuity				
UDVA (OD)	0.5	0	-0.1	-0.1
UDVA (OS)	0.6	0	-0.1	-0.1
BCVA (OD)	0.2	-0.1	-0.1	-0.1
BCVA (OS)	0.2	0.04	0	-0.1
BCVA (Bino)	0.2	-0.1	-0.1	-0.1

UNVA (OD)	0.4	0	-0.1	-0.1
UNVA (OS)	0.2	-0.1	-0.1	-0.1
Questionnaire				
QOV (Day)	4	5	8	9
QOV (Night)	3	7	9	9
IOL surface area exposure of near-add in photopic pupil				
OD	NA	60%	20%	20%
OS	NA	40%	NA	NA

AL=Axial length; ACD= Anterior chamber depth; QOV=Quality of vision; D=Dioptre; UDVA=Unaided Distance Visual Acuity; BCVA=Best Corrected Visual Acuity; UNVA=Unaided Near Visual Acuity; Bino=Binocular; IOL=Intraocular lens.